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We claim:

A method comprising:

initiating a search for images based on at least one query keyword in a query; and

identifying, during the search, first images having associated keywords that match the query keyword and second images that contain low-level features similar to those of the first images.

- A method as recited in claim 1, further comprising ranking the first 2. and second images.
- A method as recited in claim 1, further comprising presenting the first 3. and second images.
- A method as recited in claim 1, further comprising: 4. presenting the first and second images to a user; and monitoring feedback from the user as to which of the first and second images are relevant to the query.
- 5. A method as recited in claim 1, further comprising: presenting the first and second images to a user? receiving feedback from the user as to whether the first and second images are relevant to the query; and

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learning how the first and second images are identified based on the feedback from the user.

6. A method as recited in claim 1, further comprising: presenting the first and second images to a user;

receiving feedback from the user as to which of the first and second images are relevant to the query, and

refining the search to identify additional images that contain low-level features similar to those of the images indicated by the user as being relevant to the query.

7. A method as recited in claim 1, further comprising: presenting the first and second images to a user;

receiving feedback from the user as to which of the first and second images are relevant to the query; and

assigning a large weight to an association between the query keyword and the images deemed relevant by the user.

- 8. A method as recited in claim 7, further comprising grouping the low-level features of the images deemed relevant by the user.
- 9. A method as recited in claim 1, further comprising presenting the first and second images to a user; receiving feedback from the user identifying an example image as less relevant or irrelevant to the query for refinement of the search; and

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assigning a small weight to an association between the query keyword and the example image.

- 10. A method as recited in claim 9, further comprising identifying additional images with low-level features similar to those of the example image.
- 11. A computer readable medium having computer-executable instructions that, when executed on a processor, perform the method as recited in claim 1.
 - 12. A method comprising:

permitting entry of both keyword-based queries and content-based queries;

finding images using both semantic-based image retrieval and low-level feature-based image retrieval;

presenting the images to a user so that the user can indicate whether the images are relevant; and

conducting semantic-based relevance feedback and low-level feature-based relevance feedback in an integrated fashion.

- 13. A method as recited in claim 12, further comprising ranking the images.
- 14. A method as recited in claim 12, further comprising using images indicated as being relevant to find additional images.

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readable medium having computer-executable computer instructions that, when executed on a processor, perform the method as recited in claim 12.

16. A method comprising:

associating keywords with images to form keyword-image links; assigning weights to the keyword-image links;

presenting a result set of images obtained from an image retrieval search based on a query;

receiving feedback from a user as to whether the images in the result set are relevant to the query; and

modifying the weights according to the user feedback.

- A method as recited in claim 16, wherein the modifying comprises 17. increasing the weight of a keyword-image link for images deemed by the user as more relevant to the query.
- A method as recited in claim 16, wherein the modifying comprises 18. decreasing the weight of a keyword-image link for images deemed by the user as less relevant to the query.
- 19. computer readable medium having computer-executable instructions that, when executed on a processor, perform the method as recited in claim 16.

20. A method comprising:

presenting a result set of images that are returned from an image retrieval search of a query having at least one keyword;

monitoring feedback from a user as to whether the images in the result set are relevant to the query;

in an event that the user selects at least one image as being relevant to the query, associating the keyword in the query with the selected image to form a first keyword-image association and assigning a comparatively large weight to the first keyword-image association; and

in an event that the user identifies an example image for refinement of the search, associating the keyword in the query with the example image to form a second keyword-image association and assigning a comparatively small weight to the second keyword-image association.

- 21. A method as recited in claim 20, further comprising conducting both content-based image retrieval and semantic-based image retrieval.
- 22. A method as recited in claim 20, further comprising presenting the result set of images in a user interface, the user interface facilitating the user feedback by allowing the user to indicate which images are more relevant and which images are less relevant.

23. A computer readable medium having computer-executable instructions that, when executed on a processor, perform the method as recited in claim 20.

24. A method comprising:

computing, for each category, a representative feature vectors of a set of existing images within the category;

determining a set of representative keywords that are associated with the existing images in each category;

comparing, for each new image, the low-level feature vectors of the new image to the representative feature vectors of the existing images in each category to identify a closest matching category; and

labeling the new image with the with the set of representative keywords associated with the closest matching category.

- 25. A method as recited in claim 24, further comprising using use feedback to selectively add and/or remove keywords from the new image.
 - 26. A method as recited in claim 24, further comprising: placing the labeled new images into a holding category;

evaluating the labeled new images in the holding category to determine if any of the keywords associated with the labeled new image match the representative keywords from each category; and

assigning the labeled new image to the category that best matches the keywords associated with the labeled new image.



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27. An image retrieval system comprising:

a query handler to handle both keyword-based queries having one or more search keywords and content-based queries having one or more low-level features of an image; and

a feature and semantic matcher to identify at least one of (1) first images having keywords that match the search keywords from a keyword-based query, and (2) second images having low-level features similar to the low-level features of a content-based query.

- An image retrieval system as recited in claim 27, wherein the feature 28. and semantic matcher ranks the images.
- An image retrieval system as recited in claim 27, wherein the query 29. handler comprises a natural language parser.
- 30. An image retrieval system as recited in claim 27, wherein the query handler comprises:
 - a parser to parse text-based queries; and
 - a concept hierarchy to define various categories of images.
- 31. An image retrieval system as recited in claim 27, further comprising a user interface to present the images identified by the feature and semantic matcher.

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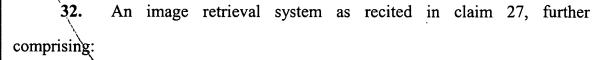
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a user interface to present the images identified by the feature and semantic matcher to a user, the user interface allowing the user to indicate whether the images are relevant to the query; and

a feedback analyzer to train the image retrieval system based on user feedback as to relevancy.

33. An image retrieval system as recited in claim 27, further comprising:

a user interface to present the images identified by the feature and semantic matcher to a user, the user interface allowing the user to identify an example image; and

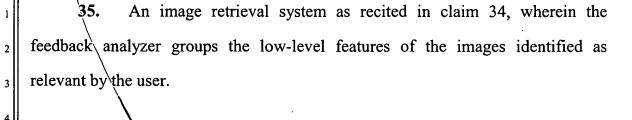
the feature and semantic matcher being configured to identify additional images that contain low-level features similar to those of the example image.

34. An image retrieval system as recited in claim 27, further comprising:

a user interface to present the images identified by the feature and semantic matcher to a user, the user interface allowing the user to identify which images are relevant to a particular search query; and

a feedback analyzer to assign a large weight to an association between the search keywords and the images identified as relevant by the user.

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36. An image retrieval system as recited in claim 27, further comprising:

a user interface to present the images identified by the feature and semantic matcher to a user, the user interface allowing the user to identify an example image as being less relevant or irrelevant to the query; and

a feedback analyzer to assign a small weight to an association between the search keywords and the example image.

- 37. An image retrieval system as recited in claim 36, wherein the feature and semantic matcher identifies additional images with low-level features similar to those of the example image.
- 38. A database structure stored on one or more computer-readable media comprising:

multiple image files;

multiple keywords; and

a semantic network to associate the keywords with the image files, the semantic network defining individual keyword-image links that associate a particular keyword with a particular image file, each keyword-image link having a weight indicative of how relevant the particular keyword is to the particular image file.

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computer-readable medium having computer-executable instructions that, when executed, direct a computer to:

find images using both semantic-based image retrieval and low-level feature-based image retrieval;

present the images to a user so that the user can indicate whether the images are relevant; and

concurrently conduct semantic-based relevance feedback and low-level feature-based relevance feedback.

- A program as recited in claim 39, further comprising computer-40. executable instructions that, when executed, direct a computer to rank the images.
- 41. An information retrieval program, embodied on the computerreadable medium, comprising the computer-executable instructions of claim 39.

